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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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TITLE: METHOD AND COMPUTER PROGRAM FOR DIGITAL IMAGE PROCESSING FOR TWO-DIMENSIONAL ELECTROPHORESIS

AMENDED CLAIMS

1. (original) Method for processing digital image data for two-dimensional arrays of sample substance spots and marker substance spots in a plurality of electrophoresis gels, comprising the steps of:

combining, for each gel, a sample with a plurality of artificial external marker substances selected from dendrimers, each such marker substance having known predefined properties;

performing two-dimensional electrophoresis on each of said gels;

generating, for each electrophoresis gel, a digital image represented by a marker image data set comprising coordinate data and signal values corresponding to detected positions and signal values of said marker substance spots, and a sample image data set comprising coordinate data and signal values corresponding to detected positions and signal values of said sample substance spots;

processing said digital images to determine a mathematical relation between the coordinate data of said marker image data sets such that corresponding marker substance spots in said plurality of gels are mapped on each other;

transforming the coordinate data of said sample substance spots according to said mathematical relation.

2. (original) The method as recited in claim 1, wherein said plurality of artificial external marker substances of dendrimers comprise added functional groups, determining net charge of the respective marker substance.

3. (original) The method as recited in claim 2, wherein said plurality of artificial external marker substances of dendrimers comprise at least one monomer, determining molecular weight of the respective marker substance.

4. (currently amended) The method as recited in ~~any of the previous claims 1-3~~ Claim 1, wherein the step of determining said mathematical relation comprises the steps of:

defining ideal image data for each gel, comprising coordinate data corresponding to ideal positions of the marker substance spots in said array dependent on electrophoresis conditions and marker substance characteristics; and

determining a mathematical relation calculated from position differences between the coordinate data of corresponding marker substance spots of the ideal image data and detected marker substance spots, which mathematical relation includes a vector-valued function that, for each gel, transforms the coordinate data of the detected positions of marker substance spots to the coordinate data of the corresponding ideal positions of said marker substance spots

wherein the step of transforming the coordinate data of said sample substance spots comprises the steps of

for each gel, transforming the coordinate data of said sample substance spots to an ideal image plane by means of the determined mathematical relation.

5. (currently amended) The method as recited in ~~any of the previous claims 1-3~~ Claim 1, wherein the step of determining said mathematical relation comprises the steps of:

determining a mathematical relation calculated from position differences between the coordinate data of corresponding marker substance spots of detected positions of said marker substance spots in a first of said plurality of gels and in a second of said plurality of gels, which mathematical relation includes a vector-valued function that transforms the coordinate data of the detected positions of marker substance spots of said first gel to the coordinate data of the corresponding detected positions of marker substance spots of said second gel.

6. (currently amended) ~~Methods~~ Method according to ~~any of the previous claims 1-5~~ Claim 1, wherein the electrophoresis gels contain a plurality of sets of, in relation to each other distinguishable, sample substances such that a plurality of sample images for each electrophoresis gel is acquirable.

7. (currently amended) Method according to ~~any of the previous claims 1-6~~ Claim 1, wherein the step of generating said sample image comprises the step of scanning the array to form a pixel image, and wherein the step of transforming the

sample image data signals comprises the step of transforming every pixel of said sample image into a transformed image, dependent on said mathematical relation.

8. (currently amended) Method according to claim 6 ~~or 7~~, wherein said array comprises two different marker substances having different properties, from which different properties coordinate data relating to ideal marker spot positions differing in at least one dimension for given electrophoreses operating conditions can be calculated.

9. (currently amended) Method according to claim 6 ~~or 7~~, wherein said array comprises a plurality of different marker substances having different properties, from which different properties co-ordinate data relating to ideal marker spot positions differing in two dimension for given electrophoreses operating conditions can be calculated.

10. (original) Method according to claim 9, wherein, dependent on the electrophoreses operating conditions, a set of marker substances is selected, comprising said plurality of different marker substances, dependent on their corresponding co-ordinates of in the ideal image data.

11. (original) Method according to claim 4, wherein the step of transforming the coordinate data of said sample substance spots comprises the process steps of:

selecting a first pixel in an image plane defined by said ideal image data;

mapping said first pixel to the sample image;

reading the detected signal value for the mapped first pixel;

assigning said detected signal value to said first pixel in the image plane of the ideal image data; and

repeating these process steps for each pixel in the image plane.

12. (original) Method according to claim 11, wherein the step of reading the detected signal value for the mapped first pixel comprises the step of:

establishing a detected signal value for the mapped first pixel dependent on the signal value of at least one pixel in the sample image adjacent the mapped first pixel.

13. (original) Method according to claim 4, wherein the step of transforming the coordinate data of said sample substance spots comprises the process steps of:

selecting a first pixel in the sample image;

reading the detected signal value for said first pixel;

mapping said first pixel to the image plane defined by said ideal image data;

assigning said detected signal value to the mapped first pixel in the image plane of the ideal image data; and

repeating these process steps for each pixel in the sample image.

14. (original) Method according to claim 4, wherein the step of transforming the coordinate data of said sample substance spots comprises the process steps of:

selecting a first pixel in the image plane defined by said ideal image data;

reading the detected signal value for the mapped first pixel;

mapping said first pixel to the sample image;

assigning said detected signal value to said first pixel in the image plane of the ideal image data; and

repeating these process steps for pixels in the image plane defining an object consisting of sample substance spots and/or marker substance spots.

15. (original) Method according to claim 4, further comprising the steps of:

determining the signal value for a first pixel in the ideal image plane dependent on the signal value of at least one mapped pixel in the ideal image plane adjacent said first pixel in the ideal image plane; and

repeating this determination process for each pixel in the ideal image plane.

16. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1 wherein the detection of positions and signal values of the marker spots is done by monitoring the shapes of the marker spots, both in two and three dimensions.

17. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1 wherein the detection of positions and signal values of the marker spots is done by monitoring the pattern(-s) of the marker spots in the gel.

18. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1 wherein the detection of positions and signal values of the marker spots is done by monitoring a combination of both shapes and pattern(-s) of the marker spots in the gel.

19. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1wherein the detection of positions and signal values of the marker spots is done by monitoring the positions of the marker spots in the gel.

20. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1wherein the detection of positions and signal values of the marker

spots is done by monitoring a combination of both shapes and positions of the marker spots in the gel.

21. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1wherein the detection of positions and signal values of the marker spots is done by monitoring a combination of both positions and pattern(-s) of the marker spots in the gel.

22. (currently amended) Method according to ~~one or more of the preceding claims~~ Claim 1wherein the detection of positions and signal values of the marker spots is done by monitoring a combination of shapes, pattern(-s) and positions of the markers spots in the gel.